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New insights in morphological characterization and modelling of supercritically CO_2 foamed bone scaffolds

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Abstract.
The high prevalence of bone diseases compromising the integrity of the osseous tissue and the increasing incidence of fortuitous severe fractures represent a global healthcare concern. [1]. The development of bone grafts from synthetic biopolymers, known as scaffolds, offers a promising outlook for the complete recovery of the bone functionality by promoting the self-healing capacity of the damaged tissue. Particularly, supercritical (sc-) CO_2-assisted foaming has been established as a versatile and efficient technology for the production of solvent-free scaffolds with remarkable *in vivo* outcomes [2].
Sc-foaming is a complex dynamic process with several processing parameters influencing the end structure of the scaffolds (porosity, pore size distribution and interconnectivity), but with a paucity of information to model this relation [3]. In this work, a combination of complementary characterization techniques, advanced X-ray microtomography (μ-CT) and mercury intrusion porosimetry (MIP) were performed to evaluate the effect of the sc-CO_2 foaming working parameters (temperature and soaking time) on the morphological properties of poly(ε-caprolactone) (PCL) scaffolds. From a step-forward point of view to its clinical use, *in silico* modelling of the cell infiltration capacity in the obtained PCL scaffolds was carried out and validated *in vitro* using mesenchymal stem cells to define the feasible operating window to obtain bone grafts with enhanced performance.

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